# OPPORTUNITIES IN THE ENGINEERING/SCIENTIFIC MARKETPLACE

INPUT

# OPPORTUNITIES IN THE
# ENGINEERING/SCIENTIFIC
# MARKETPLACE

## PHASE I REPORT

YIBX

INPUT
PARK 80 PLAZA WEST ONE
SADDLE BROOK, NJ 07662

JUNE 19, 1985

INPUT

# TABLE OF CONTENTS

I INTRODUCTION

- A. Objectives of Phase I
- B. Methodology

II EXECUTIVE SUMMARY

- A. Findings
- B. Issues and Conclusions

III THE ENGINEERING/SCIENTIFIC SOFTWARE MARKETPLACE

- A. Role of Participants
- B. Use of Software Packages
- C. Opportunities For Software Packages
- D. Other Related Factors

IV VENDOR OUTLOOK

Digitized by the Internet Archive
in 2014

https://archive.org/details/opportunitiesine00inpu

# I INTRODUCTION

## A. Objectives of Phase I

- Phase I is concerned with identifying software usage and directions in the engineering/scientific marketplace and related factors which could have an impact on computing equipment sales.

- These factors are being identified for the purpose of developing issues for further research in Phase II of the study where larger sample sizes would lend more weight to the findings.

## B. Methodology

- INPUT developed a set of questions to serve as the scope of Phase I during meetings with IBM representatives. During the course of interviews, a question was added to the list which concerned the interests of respondents in "bug" free code.

- The set of questions is shown in Exhibit I-1. It was utilized to develop a questionnaire to guide interviews. The questionnaire is included in Appendix A.

## EXHIBIT I-1

## ISSUES IN PHASE I

- Does the engineering or scientific manager have an impact on the use of computing hardware through his desire to use certain software? Is this impact changing?

- Do users categorize packages in use as 1) relevant to their disciplines, 2) cross discipline and 3) professional support in nature?

- What is the impact that each of these categories has on the selection of a computer? What specific packages have had an impact?

- Are application development or software engineering tools important to users?

- Is it necessary to heavily test packages before they are used?

- What frustrations are encountered with packages?

## EXHIBIT I-1 - (cont'd)

- Is there a need in certain disciplines or in general for software engineering to deliver bug-free code?
- Are new software packages emerging which could have an impact on equipment selection? What needs do they address?
- What unrecognized application needs are highly significant?
- What factors other than software have been important in the selection of computers for scientific and engineering applications?

- Interviews were held with respondents at 11 organizations to obtain information from directors or managers of engineering/scientific disciplines of interest to IBM. The organization and disciplines are listed in Exhibit I-2.

- Contacts were also made with IS management in 3 firms to review statements of the technical respondents.

- Contacts with software and hardware vendors was also utilized to gather information.

## EXHIBIT I-2

## DISCIPLINES SURVEYED

| RESPONDENT | DISCIPLINES |
|---|---|
| Ebasco | Civil Construction |
| Air Products & Chemical | Mechanical |
| Continental Can | Mechanics Discrete Processes |
| Sikorsky Aircraft | Aerospace Mechanical |
| Aerospace Corporation | Aerospace Aeronautical |
| Allied Technology | Chemical |
| J. T. Baker | Specialty Chemical |
| Schering | Chemical Instrumentation Lab |
| Mobil | Energy |
| Gould Incorporated | Electrical |
| G P U Nuclear | Nuclear (Mechanical) |

## II THE EXECUTIVE SUMMARY

### A. Findings

- The engineering/scientific manager has an impact on the use of computing hardware through his desire or need to use certain software according to 73% of respondents. The impact is changing, and the cost of equipment and the equipment strategy of IS have more of an influence.

- Users can categorize packages as discipline specific, cross discipline or professional support in nature. The category which has a determing influence on computer sales is discipline specific. 88% of respondents who reported that the choice of software could or did influence the choice of hardware indicated discipline specific software would influence selection. Only one respondent mentioned a cross discipline specific package (a modeling system) together with a discipline package as an influence on equipment selection.

- Respondents, however, expect to find a full set of professional support software available for engineering/ scientific computers.

- IS directors who serve engineering/scientific users or computational groups appear to be more interested in making sure that cross discipline and professional support software are available on equipment selected. Three contacted for this study made this point during general discussions.

- 50% of the specific packages that were identified as having an influence on the selection of computers were CAD packages. Modeling, finite element, thermodynamic and laboratory management packages were also mentioned.

- 64% of respondents classified some of the software that they used as application development, or software engineering tools. This software did not appear to be nearly as important to users as discipline specific software. However:

    - One (1) respondent mentioned CASE in relation to company plans to develop an AI front end for application software which was felt to be of significance.

- Software should be more heavily tested for this market since 82% of respondents report a need for testing. Testing should cover the full range that variables might cover (regression testing) rather than just what the package was developed for since over half of the respondents will use a software package for users outside of its stated purpose.

- Developers who offer multiple packages should consider a common set of standards for packages since the lack of such a standard was noted by several respondents as a problem.

- The leading frustration with packages, which was noted by 45% of respondents, was a lack of integration which made it necessary to rekey data.

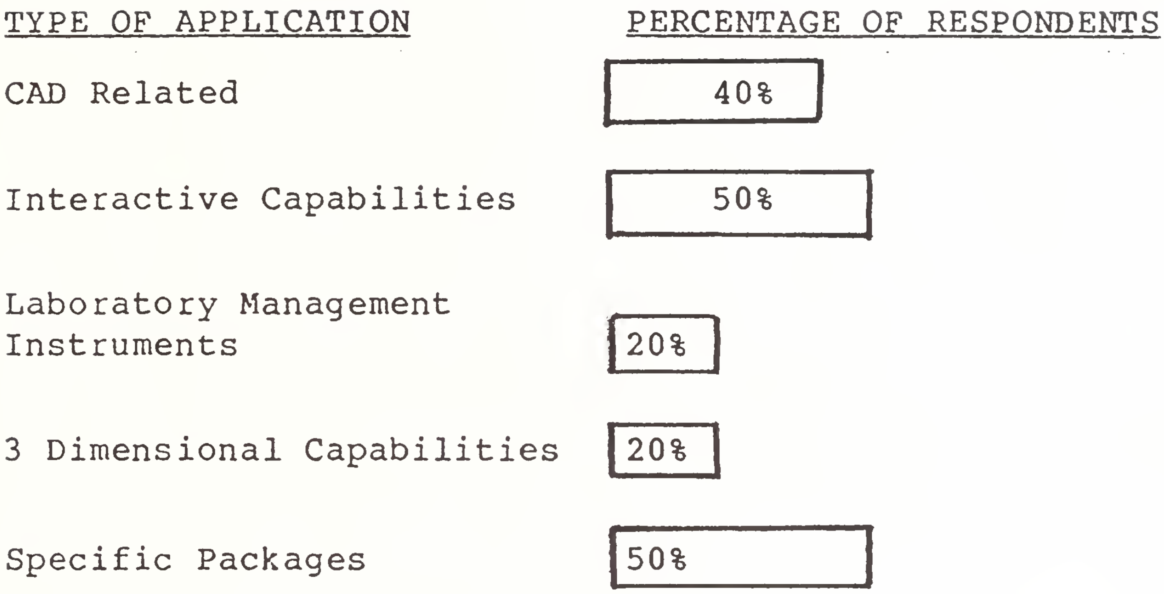
- 40% of the emerging discipline specific packages which respondents feel to be significant involve CAD as shown in Exhibit II-1. The expansion of CAD capabilities and techniques is recognized as an opportunity by turnkey vendors.

    - Applicon feels that they have scored a breakthrough in offering software that will handle the design of electrical circuits in 3 dimensions within machinery.

    - CALMA is developing a "CAD" type of approach for chemical engineering which may sell a significant number of turnkey systems.

## EXHIBIT II-1

### TYPES OF APPLICATIONS IDENTIFIED AS EMERGING DISCIPLINE SPECIFIC



- Apart from the mention of CAD, 50% of emerging discipline specific applications offer interactive capabilities of interest to respondents. This interest together with the mention of CAD suggests that engineers and scientists are increasingly interested in software that involves them more with a display and input activity. Two chemical engineering managers discussed a desire to move away from the remote batch computation that they were doing on mainframes to a more interactive experience. One referenced the type of interactive computation he had seen at a DEC installation handling a mechanical design problem. GE CALMA feels that an opportunity is available here for the introduction of interactive, visually oriented methods to chemical computation.

- 20% of emerging discipline specific applications address 3 dimensional capabilities. This capability was also represented in one of the five emerging cross discipline applications. Turnkey vendors believe that 3 dimensional modeling and design represents a significant opportunity.

- 20% of the significant emerging applications involve laboratory management systems for use in instrumentation laboratories. More comprehensive systems are needed according to two respondents as well as to several software vendors.

- 40% of emerging cross industry applications dealt with interactive graphical types of capabilities. Other capabilities that were mentioned included three dimensional simulation, a modeling package and the use of AI techniques to help engineers use packages.

- Unmet needs that were mentioned by respondents are categorized in Exhibit II-2. Needs to integrate programs and provide an engineering/scientific database capability rank first and second.

- The need for a database capability is not just to aid in the integration of programs. Respondents feel that this capability has to be oriented to aid researchers perform jobs as well as to provide relations between jobs or disciplines. The capability should present a narrow view to specific users and a more general view to others. One respondent also feels that the database capability should help the user to translate his ideas into a form that would facilitate computation.

- The need to utilize AI techniques to aid researchers in the use of computing is regarded as an opportunity by both respondents and some software vendors. These techniques could subtantially lessen the work involved in using packages and help a researcher make logical choices (decide

## EXHIBIT II-2

## CATEGORIES OF UNMET NEEDS

| UNMET NEEDS | PERCENTAGE OF RESPONDENTS |
|---|---|
| Database related need | 45 |
| Engineering/Scientific Database | 33 |
| Database of Technical Information | 11 |
| Integration of Programs | 33 |
| More use of Al | 11 |
| Three Dimension Capabilities | 11 |

what to do next or what is needed) before computation is initiated or during interaction.

- The expanded use of three dimensional capabilities is an unmet need recognized by both respondents and vendors in mechanical, electrical and chemical fields to handle:

    - Three dimensional mechanical design.

    - Fluid and air flow.

    - Modeling of molecules in 3 dimensions.

- Among other needs, it is felt that more satisfying methods are needed to enter data that refers to three dimensional models or drawings on a display.

- Apart from the discussion of unmet needs, a chemical and an aeronautical engineer mentioned that there were problems in software for robots regarding the information standards being adopted. The chemical engineer, who referred to SECHS I and SECHS II as character standards not approved by ANSI, felt that someone such as IBM should be addressing this matter or planning future steps to resolve the situation.

## B. Issues and Conclusions

- Issues that were identified during this study included:

  - Whether the budgets that can be used for the purchase of software are under the control of the engineering/scientific groups, IS or another group or are split between them.

  - The relative influence of engineering/scientific managers and IS management in the selection of computers and the factors including application packages that influence selection.

  - If factors involved with the use of cross discipline and professional support types of software are brought to the attention of engineering/scientific user by IS management (who might have been contacted about these capabilities by hardware or software vendors).

  - If vendors, particularly turnkey vendors, are more aware than users of the need for software engineering techniques, and the need to deliver bug free code.

- What developments in interaction and the use of visual information on displays, introduced through CAD will be attractive to users in various disciplines and particularly to chemical engineers. Whether any of these developments offers a significant opportunity.

- What improvements in CAD, simulation and other packages needed for three dimensional problems offer an opportunity to software developers.

- If more expanded capabilities are needed for the management of laboratory instrument automation.

- What specific packages noted by respondents represent a significant opportunity in application software.

- What steps should be taken to address the needs for more integration of software and engineering/ scientific databases.

- If the use of AI in application software will become popular as a solution to user problems.

- In addition to these issues, Phase I demonstrated that:
    - Software can be identified which is having an influence on equipment selection.
    - Information can be obtained about experiences with packages that could be used in planning strategies for marketing software or marketing hardware where the sale might be dependent on application software.
    - Software opportunities can be uncovered for further investigation.
- On the basis of the results obtained in Phase I, it appears that the next phase of this study should utilize interviews with directors of IS and vendors of software as well as managers of engineering/scientific groups in order to expand and examine the ideas of these managers further.
- The issues for further research in Phase II should be formulated on the basis of the scope used in Phase I and the findings, issues and data gathered during this phase.

# III THE ENGINEERING/SCIENTIFIC SOFTWARE MARKETPLACE

## A. Role of Participants

- 7 of the respondents were managers of engineering/scientific groups who used computing. 4 were engineers by training who were managers or directors of computational groups serving engineering/scientific users.

- All respondents reported that they were involved in the process of deciding when computation would be used and in the selection of packages.

    - 82% said they were involved in deciding if applications would be developed or purchased.

    - All said that they were involved in selecting packages and 73% said they helped determine the final selection.

- 73% of respondents reported that the choice of software did have or could have a strong role in the selection of computers. The software that they referred to is listed in Exhibit III-1.

## EXHIBIT III-1

## APPLICATION SOFTWARE PACKAGES THAT INFLUENCED HARDWARE SELECTION

| PACKAGE | HARDWARE |
|---|---|
| Integraph (mentioned twice) | DEC |
| Bravo | DEC |
| GT Strudl | DEC |
| CADAM | IBM Mainframe |
| CATIA | IBM Mainframe |
| Specialized plotter software | DEC |
| Mark (Finite elements) | DEC |
| Mental (Finite elements) | DEC |
| Thermodynamic processes | DEC |
| LIMS (Laboratory Management) | HP 3000* |
| GE CALMA DDM | DEC |
| Modeling (contrust. Syst) | DEC |

* MOST FLEXIBLE ON HP EQUIPMENT.

- Two IS directors in the firms of these respondents said that IS equipment strategies would have the deciding impact on the selection.

- In the case of one respondent who said that he was not free to select equipment, an IS director reported that the respondent has been persuaded to accept an HP 3000 instead of a DEC VAX and was having his computing done on the HP 3000 and a central IBM 4341. The respondent stated that the split in the use of packages between these machines was at the heart of his frustration with current software and that he was looking for a large scale approach to instrumentation and his database needs that would support a local capability.

- Three respondents who felt that they could select equipment commented that their roles in selection might be dependent on the cost of equipment and IS strategies. Several other respondents felt that the importance of the work would allow them to dictate equipment selection.

- The issues that emerge from this section are:

    - The relative influence of IS management and engineering and/scientific users in various disciplines in the selection of computing equipment.

- The factors including business dependence on engineering/scientific work, application software to handle this work, computing resources required and IS equipment strategy that influence equipment selection.

- Whether alternate choices of software were not available.

## B. Use of Software Packages

- All respondents used purchased application packages. 64% (7) relied chiefly upon or emphasized the use of purchased packages more than developed software.

- Two of the four respondents who relied more upon developed software were interested in capabilities that might be obtained through purchased packages (i.e. more interaction, graphics or other visual output to aid the user, database capabilities, etc.)

- 5 of the respondents noted that it was difficult to obtain information about all the packages that are available. This makes them interested in discussing software capabilities with both software and hardware vendors. DEC, Data General, HP and Apollo representatives try to serve this need according to respondents.

- The specific, purchased packages mentioned by name are listed in Exhibit III-2.

- All respondents agreed that purchased packages and developed application software could be divided into discipline specific, cross discipline and professional support.

## EXHIBIT III-2

## PURCHASED SOFTWARE PACKAGES IN USE (PARTIAL LIST)

Strudl (2)

Nastran
Ansys

Integraph
Modeling (2)

Lotus 1 2 3
D Base III

Ingres
Focus

Simplex
Rotodynamics

Aftran
Sat 4

Aspen
Bravo

RS/1
Autocad

CADAM
Catia

Tell-A-Graf
Mark

Mental
Thermodynamic

CALS
CESAR II

Pert

Lims
Lims II

Snapware
Gas Chromatography

Peak II
Lisp

Intellect
Circuit

GE CALMA DDM

Other packages in use could not be identified correctly or were mentioned in terms of functions

Many mentions of word processing, project management, spreadsheets and other support systems without mentioning specific names

- Respondents, in general, seemed to focus more attention on discipline specific software. If cross discipline software was important to a respondent, it was difficult to separate it or draw a line between it and discipline specific software. Interactive graphics and database capabilities were seen in terms of the user's discipline although several respondents that discussed this issue further agreed that some of these capabilities should be thought of as cross discipline. Data General, GE CALMA and other vendors that I discussed this point with felt that it was important to discuss cross discipline capabilities from the standpoint of the user's discipline in most cases since a discipline or application oriented outlook is more apt to sell.

- The need for support packages is recognized by all respondents and vendors such as DEC, DG and HP supply word processing, project management, spread sheet, data management and other capabilities. No specific package other than Lotus 1-2-3 and a few database packages were mentioned by name however. A hardware vendor should have these capabilities, but they are not as important in equipment selection as discipline specific software.

- 82% of respondents thought that discipline specific packages could have an influence in selecting computers. Two felt that substitute packages might be found to run on various computers so that these packages might not have the only role in determining equipment. One respondent noted that the desire for local autonomy would lead scientific/-engineering users to argue that they needed a specific computer to run certain packages. The only force that he saw in conflict with this was the desire of many users for the access to more MIPS.

- Seven respondents characterized some of their software packages as application development/software engineering tools.

    - 3 mentioned use of a DBMS or data management capability.

    - 2 mentioned a modeling language.

    - 1 mentioned software design involving interactive techniques, graphics and computer assisted instruction as well as the use of LISP.

- Only 2 respondents referred to bug free code and one did in relation to software from CALMA. The turnkey vendors such as CALMA, Applicon, Integraph and McAuto, who are more aggresive in the market, noted the need for good code. Other software vendors contacted during this study did not mention this need to any extent.

- Although respondents do not concentrate upon bug free code, 82% stated that software packages have to be heavily tested. 55% said that this was done to find out what would happen when variables were outside the ranges normally used with this package as well as to test for errors. Some respondents commented that packages were often tried out for new types of applications so that it was necessary to find out how they would respond through testing.

- Other respondents noted that heavy testing was necessary to overcome a lack of documentation in packages, the lack of standards across packages and the need to shake out bugs. The latter point was made by a respondent who was involved with designing and running discrete processes, and was interested in bug free code.

- 45% of the respondents noted that they were frustrated by the need to rekey data output from one package into another package. They felt that integrated software or databases were needed to reduce this.

- 2 respondents mentioned frustrations in learning and remembering how to run a package and one respondent claimed that many packages were frustrating because they had poor interaction with users.

- 2 respondents noted that they were frustrated by the problems that could occur when data was outside the range which the package would accomodate.

- One respondent mentioned that new packages were frustrating because they seldom worked as expected and another noted that you had to find out what the problems were with new packages.

- A conclusion that emerges from this section is that a software vendor should try to obtain a reputation by adhering to a set of standards for software development and testing in this market.

## C. OPPORTUNITIES FOR SOFTWARE PACKAGES

- Software that respondents felt to be significant are listed in Exhibit III-3. 4 of the 10 applications that were mentioned involved CAD. The interest in CAD is partially driven by the use of interactive techniques and graphical/visual means of providing information that CAD packages utilize. Two respondents from chemical disciplines felt that these techniques could improve productivity for engineers in their companies.

- Five other packages that were noted as significant also stressed interaction.

- Noting the interest and desire for more use of visual, imagery and interaction in other disciplines and particularly in chemistry, GE CALMA is developing a system for use in chemical engineering and testing it at GE Research in Schenectady. It is felt that this system could be very popular. Research is probably needed to assess the popularity and to review the relationships between variables and results as well as the interactive steps that would be of greatest interest to users.

## EXHIBIT III-3

## APPLICATIONS THAT STAND OUT IN VARIOUS DISCIPLINES

| PACKAGE | DISCIPLINE |
|---|---|
| CALS (laboratory management system of Beckman Instruments) provides better interaction | Chemistry Lab. Instruments |
| New CAD with expanded graphics | Aerospace |
| CESAR II pipe stress on PC (terrific front end interaction | Chemical |
| ASP system developed by MIT for Department of Energy (Interactive) | Mechanical |
| LIMS, laboratory instrument management system, (Interactive) system (queries, histograms, tables of frequences, ability to customize) | Specialty Chemical<br>Lab Instruments |
| Display of an object deforming under stress during simulation (interactive capabilities noted) | Mechanical |
| CAD Graphics | Civil Engineering |
| New CAD 3 dimensional capabilities | Aerospace |
| More use of AI in interactive packages | Electrical |
| GE CALMA DDM | Nuclear (Mechanical) |

- Two of the important applications mentioned by respondents involve management of information for laboratory instrument systems where users are concerned with obtaining more information and expanding computation and the retention of information.

- The items mentioned by respondents in regard to cross discipline applications listed in Exhibit III-4 also stressed interaction. 3 of the 5 applications mentioned dealt with means of aiding users:

  - User friendly software.

  - Interactive graphics.

  - AI techniques to help engineers use packages.

- These items reflect the frustration that some respondents mentioned in following the instructions to run packages.

- The modeling package that was mentioned by a respondent as a significant cross industry application was developed by a firm that "follows" CAD and CAD/CAM firms into installations. This firm attempts to capitalize on the consulting opportunities presented when a company buys a CAD System without fully studying how they will utilize it.

## EXHIBIT III-4

## SIGNIFICANT CROSS DISCIPLINE APPLICATIONS

- New graphics oriented, user friendly software used on DEC for CAD (Chemical).
- Interactive graphics on DEC VAX vs mainframe TSO or VM/CMS (Mechnical).
- 3 dimensional simulation (Fluid mechanics).
- Al techniques that help engineers to use packages (Aerospace).
- New modeling package by construction services (Electrical).

Disciplines where they are of interest are shown in parentheses.

- A list of unmet needs is shown in Exhibit III-5. One third of the needs concern the integration of programs, the ability, for example, to pass data from an analysis package to a design package and then to a cost estimation model. This would reduce the need to rekey data which is one of the frustations that engineering/scientific users mention.

- The need for integration is one of the factors encouraging interest in a scientific or research oriented database. About 45% of unmet needs concern such a database, and 75% of those items relate the need for a database to the need to integrate applications. One respondent noted that his company was trying to adapt IDMS and IDMS/R to that purpose.

- Respondents also noted the need for databases of properties of materials and variables used in tests.

- One respondent noted the need for a database that would help a researcher express his ideas and translate them into a form that could be used in computation. This respondent was developing an AI front end for packages to make it possible for electrical engineers to use packages without remembering all the rules and required code sequences. He planned to have the AI front end respond to questions from

## EXHIBIT III-5

## SIGNIFICANT UNMET NEEDS

- Need for a common test dictionary that lists variables (Chemical).
- Database capability and program integration (Chemical).
- Better database capability than IDMS-IDMS/R (Mechanical).
- Need AI (computer aided techniques) to use packages (Aerospace).
- Common database of physical properties of materials to use with applications (Chemical).
- Interface new languages or program development capability to extensive FORTRAN libraries (Chemical).
- Chemical workstations that would model molecules in 3 dimensions (Chemical).
- More interaction and graphics and a full screen editor to aid input (Energy).
- More integration of applications (Energy).
- More powerful mid sized machines with software to handle a group of instruments and provide more analysis (Specialty Chemical).
- Database or integration to save results between related jobs (Fluid Mechanics).
- Database and more integration of jobs (Civil).
- Better means of handling 3 dimensional design (Aerospace).
- Simulation of fluid and air flow (Fluid Mechanics).
- More use of AI (Aerospace).
- Database and AI techniques to facilitate idea or symbolic manipulation (Electrical).
- Scientific database and program integration (Nuclear Mechanical).
- Integration of programs (Mechanical).

an engineer about the use of chips, network planning or other research issues by selecting the packages to run and telling the engineers what additional data might be needed.

- Two aerospace respondents also felt AI techniques should be utilized to reduce the work of using packages.

- These points about the use of AI as well as the needs that were noted for more interaction and the use of displayed pictures or graphics suggest a general desire to change the approach toward using packages. Three respondents stated this during conversations. Many software and turnkey vendors contacted during the study also felt that a desire for change was apparent, and they were considering marketing and product development moves to react to the situation. The existence of such a feeling and the factors that are involved in it represent an issue that should be explored further.

- Specific unmet needs that were mentioned by individual respondents which should be investigated further include:

    - Better means of handling 3 dimensional design.

    - More computational power and information storage capabilities for laboratory instrument computation.

  - Chemical workstations that would model molecules.

- Software and turnkey vendors mentioned items similar to all three items listed above as applications that offered opportunities.

## D. Other Related Factors

- As noted in section III B, respondents seek aid or information about software packages from vendors and some hardware vendors address this need in order to promote sales.

- Scientific/engineering users also look for contact and coordination from hardware vendors in regard to their applications needs. Three respondents mentioned instances in which IBM representatives did not handle contact with them adequately and non IBM computers were obtained.

  - In one of these instances, a technical group from IBM, who were extremely competent in instrumentation, visited a site without the sales representative and were not able to present a story that correlated with his remarks about computing equipment.

  - In another situation, a sales reprsentative appeared to have little knowledge or interest in how a computer would be used in certain applications.

  - In the third instance, IBM representatives did not have sufficient information to support an IS plan to upgrade a central computer rather than install a local, small computer for a user. The small computer was installed.

- These illustrations as well as the general comments expressed by respondents and vendors about the need to make contact and listen to engineering/scientific users support that there are issues here that need further exploration:

  - What capabilities or characteristics are needed by hardware and software vendor representatives in serving engineering/scientific issues?

  - How important are these characteristics in relation to the sale of hardware and software?

## IV VENDOR OUTLOOK

- Hardware, software and turnkey vendors contacted during the course of this study felt that changes were occurring in the marketplace, and they were planning moves to counteract or take advantage of the situation.

- Data General feels that the turnkey vendors associated with CAD will continue to have a considerable impact on the selection of equipment and is taking steps to make sure that DG equipment can be used.

- Turnkey vendors involved with CAD believe that they have many opportunities to expand their business in new uses of the interactive techniques used in CAD with current users and in new disciplines.

- These vendors will have an impact on the sale of other software by promoting interaction, integration and database capabilities.

- IMSL feels that the selection of packages including libraries could be influenced by the vendors offering turnkey CAD systems or by other vendors offering interactive, computer

assisted types of packages. Consequently, IMSL is expanding the equipment that its software will run on and investigating what new software directions might provide more of an opportunity to control the selection of software in general.

- GE CALMA is working with Georgia Tech in order to provide an interaface to an improved version of STRUDL. When this is done, CALMA will promote the use of STRUDL in place of packages that would formerly have been deemed acceptable if the user wanted to acquire them.

# APPENDIX A

## QUESTIONNAIRE FOR IBM SCIENTIFIC/ENGINEERING

Company and respondent information (define respondent group or activity).

1. Have you been influential in the purchase of scientific and engineering application software?

YES______ NO______ (DO NOT PROCEED)

2a. What has your role been?

CHECK ALL THAT APPLY:

Deciding when computation will be used. ______

Deciding when the application will be devloped or purchased. ______

Directing or participation in the selection.

Directing ______ Participation ______

Selecting the computer that will be used ______

2b. What was the dollar volume of package acquisition during the past 12 months? __________

3. Which packages have your group made the greatest use of in the past 12 months?

| PACKAGE(S) | PURCHASED OR DEVELOPED | EQUIPMENT |
|---|---|---|

4a. Which of the above packages are specific to your scientific or engineering field? ____________________________________

____________________________________________________________

____________________________________________________________

____________________________________________________________

4b. Which of the above packages are technical in nature but could support many scientific and engineering fields?

________________________________________________

________________________________________________

________________________________________________

________________________________________________

4c. Which packages provide application development or software engineering tools? ______________________________

________________________________________________

________________________________________________

________________________________________________

4d. Which could be thought of as professional support in nature; e.g. project management/scheduling; or word/text processing? ____________________________________

________________________________________________

________________________________________________

________________________________________________

5. Would any of these classes of packages have a strong role in determining the selection of the computer to be used?

YES _____ NO _____

Why is that? ______________________________________________

____________________________________________________________

____________________________________________________________

6. Do you find it necessary to test packages heavily before you use them? Please comment. __________________________

____________________________________________________________

____________________________________________________________

____________________________________________________________

7. What types of frustrations do you encounter with packages? Please describe. ________________________________________

____________________________________________________________

____________________________________________________________

____________________________________________________________

8. In your opinion, what types or specific application packages, other than the ones you use , stand out in your discipline? ____________________________________________

____________________________________________________________

____________________________________________________________

____________________________________________________________

9. Have any new application packages just come to your attention that appear to be significant? (i.e. they address unrecognized needs that you regard as significant in your field and in many scientific and engineering fields)?

YES______ Please describe ______________________________

________________________________________________________

________________________________________________________

________________________________________________________

NO______ (Do not say "other" in question 10)

10. What other needs in your area are significant enough to warrant the development of a package by a software firm?

________________________________________________________

________________________________________________________

________________________________________________________

________________________________________________________